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ABSTRACT

The Feasibility of developing an index to represent the degree of consistency with which a student responds to a set of items in a homogeneous scale is investigated. The dispersion of responses to a set of items by a group of subjects has typically been measured by the standard deviation. Here, the interest is in the dispersion of responses from the same subject to a set of items. The Ohio Vocational Interest Survey was used to gather students' responses to 11 items (job-activity statements) in terms of a 5-option scale. The investigation consisted of 3 phases: (1) a scale clarity index (SCI) was devised; (2) all possible response patterns were defined and the clarity of each was rated in terms of degree of consistency; and (3) the extent to which the deviation raw score, the standard deviation, mean deviation, and a centrality index would predict the scale clarity rating developed in the second phase was investigated. A critical aspect of this study is the judges' ratings of the clarity inherent in each pattern. The SCI provides additional information as to the nature of a subject's responses, is useful in the interpretation of raw scores, especially those based on individual item responses, and has great promise in testing and measurement practice. (TA)

A MEASURE OF SCALE CLARITY*

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Background

Individual variations in responding to the statements within a scale consisting of a set of homogeneous items appear to have been overlooked as individual idiosyncracies or normal measurement problems. However, information about an individual's consistency in responding to a set of homogeneous statements can give added meaning to the interpretation of his responses to the items in a scale. How can this information be quantified and reported in a practical manner?

Purpose

The purpose of this investigation is to examine the feasibility of developing an index to represent the degree of consistency with which a student responds to a set of items in a homogeneous scale. The dispersion of responses to a set of items by a group of subjects has typically been measured by the standard deviation. This study is interested in the dispersion of responses from the same subject to a set of items.

Method

The Ohio Vocational Interest Survey (OVIS) (D'Costa et al, 1969) is an instrument designed to help high-school students to explore the world of work. OVIS consists of 24 scales, each comprising 11 job-activity statements which were judged to be representative of a particular area within the world of work. The OVIS scales were initially derived on an a priori basis from the Cubistic Model of Vocational Interests (D'Costa and Winefordner, 1969). The items comprising the scales were selected and defined empirically to provide homogeneity in the scales.

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In OVIS, students are asked to respond to each job-activity statement in terms of the five-option scale, "Like very much," "Like," "Neutral," "Dislike," and "Dislike very much." In computing a score for each scale, a value of 1 is assigned to "Dislike very much," 2 to "Dislike," 3 to "Neutral," 4 to "Like," and 5 to "Like very much." A scale score is defined as the sum of a student's responses to the 11 items in the scale and indicates the strength of his liking for the job activities that make up that scale. A scale score can range from 11 to 55. Thus, to obtain a scale score of 49, a student must indicate that he "likes very much" most of the activities making up that scale. His average response score of 4.5 reflects the level of his responses. However, for scale scores in the middle range of 24 to 42, the average response score may not accurately reflect the variations of a student's interests within the scale. For example, a student with a scale score of 33 could be uniformly neutral to the activities making up the scale, or his score could represent the sum of high and low weights reflecting likes as well as dislikes. Since the 11 items were selected to yield a homogeneous scale, the degree of consistency with which a student responds to the items can be considered to be an index of scale clarity that the individual has attained within himself.

The first phase of this investigation considered a scale clarity index (SCI) which was defined as a linear function of the standard deviation of the individual's responses to the 11 items in a scale. Of course, many different patterns of response are possible. For example, one pattern of responses is:

Response Type	D	d	N	l	L
Weight	(1)	(2)	(3)	(4)	(5)
Pattern of Response	0	0	0	2	9

Here, the mean response weight is 4.8 (scale score of 53) and the standard deviation of responses is 0.4. The scale clarity score was defined as 25 - 10(s.d.). The interpretation of this score was done on a normative basis, that is, with reference to the frequency distribution of scale clarity scores obtained by a criterion group. A decision was made to label scores at or above the third quartile (Q_3) as highly consistent, those between Q_1 and Q_3 as fairly consistent, and those at or below Q_1 as inconsistent.

There were several limitations noted with respect to this approach:

1. It was assumed that the standard deviation, or a function of it, alone is an accurate measure of scale clarity inherent in a response pattern.

2. That it is appropriate to interpret the scale clarity score for an individual in reference to a norm group. An index of the subject's level of consistency thus becomes dependent upon the consistency of others.

3. The normative approach, which was applied independently for each scale, implies that it is appropriate to use different standards to judge clarity in different scales. Thus, a student with the same response pattern on two different scales and showing the same consistency within himself, could conceivably be labelled "highly consistent" on one scale and "fairly consistent" on the other.

The second phase of this investigation proceeded on the premise that the response pattern is the key to the clarity question. Furthermore, it was believed that scale clarity can be best defined in an absolute and uniform manner. It was decided to: 1) Define all possible patterns of response to the 11 items in a scale, 2) Use experienced judges to rate the clarity perceived in each of the possible patterns of response as "Highly Consistent," "Fairly Consistent," or "Inconsistent," and 3) Compute the raw score and the standard deviation or variance corresponding to each pattern.

To determine all possible patterns of response, it was recognized that there are 11 items in a scale, that the subject responds independently to the 11 items, and that the subject can respond to each item in any one of five different ways. The simulation took note of the fact that in any one scale, a response could be made not at all, or as many as 11 times. It was found that there are 1365 unique response patterns possible. A complete listing of these 1365 patterns and their standard deviations was obtained by a computer simulation program. But since it was found that the 1365 patterns yielded only 116 unique standard deviations, the use of the standard deviations alone as a measure of scale clarity was deemed inappropriate.

Since a particular standard deviation could result from apparently different patterns of consistency, each of the 1365 patterns was examined to identify the clarity inherent in each. A panel of three judges was instructed in the technique and a set of ratings from each judge was obtained. Clarity was looked at in terms of the homogeneity of the responses, i.e., the number of identical responses, the number of dissimilar responses, and the location of the cluster of responses on the 5-point response continuum.

It was noted that the patterns occurred symmetrically around the raw score of 33. Extreme scores, such as 11-17 and 49-55, had patterns that reflected highly consistent responses; the inconsistent response patterns occurred generally in the middle range of scores. As expected, most of the greater standard deviations occurred in the middle range of scores. Therefore, each pattern's raw score and standard deviation were examined along with the judges' ratings in an attempt to produce meaningful scale clarity indexes.

The second phase ended with the development of a table to permit one to read off a scale clarity index corresponding to a particular raw score and standard deviation.

The third phase of this study is an investigation of the extent to which the deviation raw score (defined as the absolute value of the raw score minus 33), the standard deviation, mean deviation, and a centrality index (defined as a mean deviation around the "Neutral" response) would predict the scale clarity rating developed in the second phase.

Results and Conclusions

Table 1 presents the intercorrelations among the four predictor variables, i.e., deviation raw score, standard deviation, mean deviation, and centrality index, and the criterion variable, namely the scale clarity index determined under Phase 2.

Table 1. Intercorrelations among the deviation raw score, standard deviation, mean deviation, centrality index, and scale clarity index for every possible pattern of response for the OVIS scales.

	DRS	SD	MD	CI	SCI
Deviation Raw Score	1.00	-.31	-.32	.43	.67
Standard Deviation		1.00	.96	.63	-.77
Mean Deviation			1.00	.61	-.76
Centrality Index				1.00	-.23
Scale Clarity Index					1.00

It is interesting to note that the deviation raw score, the mean deviation, and the standard deviation each predicts the scale clarity index determined by the panel of judges at a relatively high level.

However, since certain of the predictor variables are highly correlated, the second stage in this phase of the investigation was concerned with the determination of measures as unique predictors of scale clarity. For this reason, a stepwise regression analysis was undertaken to determine those

measures yielding the greatest multiple correlation in the prediction of criterion. Table 2 presents the results of this analysis.

Table 2. Stepwise regression analysis of the deviation raw score, standard deviation, mean deviation, and centrality index as predictors of the scale clarity index.

	Predictor	R	R^2
Step 1	Standard Deviation	.766	.586
Step 2	Standard Deviation Deviation Raw Score	.890	.793
Step 3	Standard Deviation Deviation Raw Score Centrality Index	.897	.805

The results of this analysis are not surprising for the response patterns judged to be inconsistent occurred generally in the middle range of scores where the standard deviations are also generally greater.

However, a critical aspect of this study is still the judges' ratings of the clarity inherent in each pattern. How to improve the accuracy of this criterion still remains a problem. The approach in this on-going phase of this study will be one of successive approximations. Thus, we hope we can improve our scale clarity indexes and, in turn, go on to quantify them to reflect the within-subject variability in a set of homogeneous items in a scale.

The scale clarity index provides additional information as to the nature of a subject's responses and is useful in the interpretation of raw scores, especially those based on individual item responses, and has great promise in testing and measurement practice.

The scale clarity index also provides an interesting question for statisticians. How good a measure of dispersion is the standard deviation? To what extent does the mean deviation supplement the information provided

by the standard deviation. Can some other index, such as the centrality index, be developed, which might add to the definition of the clarity in a response pattern?

This study does not have the answers to all these questions. But its value lies in the fact that it can be useful in measurement practice. Use of the concept in relation to the Ohio Vocational Interest Survey suggests that it is indeed useful.